CALIFORNIA DEPARTMENT OF TRANSPORTATION

Independent Assurance Program Annual Report
Calendar Year 2008

Division of Engineering Services
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OVERVIEW

INTRODUCTION

Title 23 of the *Code of Federal Regulations*, Chapter I, Part 637, Subpart B, Section 637.205(a) (23CFR637.205(a)), the Federal Highway Administration's (FHWA's) quality assurance procedures for construction require the following:

> Each STD [state transportation department] shall develop a quality assurance program which will assure that the materials and workmanship incorporated into each Federal-aid highway construction project on the NHS [National Highway System] are in conformity with the requirements of the approved plans and specifications, including approved changes.

Key components of this quality assurance program are "acceptance" and "independent assurance." Independent Assurance (IA) programs may be project or system-based. The California Department of Transportation (Caltrans) has chosen to implement a system-based IA program.

Agencies choosing to implement a system-based IA Program are required by 23CFR637.207(a)(2)(iv) to submit an annual report. In fulfillment of this requirement, this report is being submitted concerning activities of the Caltrans IA Program for calendar year 2008.

ANNUAL REPORT OVERVIEW

The Caltrans Independent Assurance (IA) Program provides a framework for ensuring that the quality assurance program, as outlined in the Caltrans *Construction Manual* and in project specifications, is supported by qualified technicians and accredited laboratories. The Caltrans IA Program provides periodic evaluation of the performance of sampling and testing personnel, testing equipment, and testing laboratories.

Caltrans is committed to developing and maintaining qualified testing staff; maintaining calibrated equipment and accredited laboratories; ensuring technicians and laboratories that provide test results to the State that will be used in acceptance consideration meet the same standards; and ensuring that projects are constructed using quality materials.

The purpose of this document is to provide:

- A brief overview of the Caltrans IA Program
- A discussion of IA activities from January through December 2008
- A discussion of the current IA Program and recommendations for proposed changes in the future
- Information on the Reference Sample Program (RSP)
- A look at the future of the IA Program in the short term (1–2 years) and long term (3–5 years)

SUMMARY OF ACTIVITIES: CALENDAR YEAR 2008

This 2008 Annual Report will discuss the following activities:

- **Technician Qualification** – Materials Engineering and Testing Services (METS) IA staff and district IA staff qualified a total of 2558 technicians in Caltrans, local agencies and commercial laboratories in 2008.

- **Laboratory Accreditation** - METS IA staff and district IA staff accredited a total of 322 Caltrans, local agency and commercials laboratories.

- **New District IA Staff Certification** - METS IA staff certified 2 new district IA staff in 2008.

- **District IA Staff Recertification** – METS IA staff recertified 29 district IA staff in all 12 districts.

- **New IA Staff to Support Local Agencies** – In 2008, METS IA hired an additional 5 employees to provide IA services for California local agencies using Caltrans standards.

- **District Process Reviews** - METS IA staff conducted district IA process reviews with follow-up visits in all 12 districts.

- **Equipment Calibration by METS IA Staff –** METS IA staff calibrated large equipment in 13 Caltrans and 16 local agency testing laboratories.

- **Reference Sample Program (RSP)** - The Reference Sample Program sent out proficiency samples to participating laboratories in fine aggregate, PCC and soil in 2008.

- **Statewide Database Development** – METS and Caltrans Information Technology (IT) developed a web-based database to contain all IA related information. User training for this program was done in July 2008.

- **Test Method Modification** – METS IA continued to work with district IA staff to modify test methods related to nuclear gage calibration. The following test methods are currently being modified: California Test Methods (CT) 111, 121, 231, 375 and 552.

- **The 2008 Annual IA Meeting** - The 2008 Annual IA Meeting was held on December 2 and 3, 2008. Issues such as: AASHTO accreditation, local assistance independent assurance, district IA practices and continued implementation of the new hot mix asphalt specifications were discussed.

1. CALTRANS INDEPENDENT ASSURANCE (IA) PROGRAM

1.1 BACKGROUND

Since 1992, Caltrans has been committed to an IA program. Guidance for the program is outlined in the *Caltrans Independent Assurance Manual*, which can be located at the following website address:

http://www.dot.ca.gov/hq/esc/Translab/ofpm/IAP.htm

In 1994, Caltrans shifted from a project-based process for reviewing technicians, equipment, and results to a system-based process. In the system-based process, a technician's qualifications are ascertained by written examinations, witnessed performance of tests, and results of testing on split samples of materials for corroboration of test results. Caltrans IA staff reviews equipment and laboratories annually; and laboratories participate in a statewide proficiency sampling program. 23CFR637.207(a) provides that this approach removes the necessity of project-specific samples.

Caltrans views independent assurance as an important and integral part of its quality assurance program, but separate from individual project quality assurance efforts. Independent assurance is implemented by METS. The Division of Construction ensures individual project quality assurance. Quality assurance at the project level is outlined in the *Construction Manual*, which is located at the following website address:

<http://www.dot.ca.gov/hq/construc/manual2001/>

In keeping with the requirements of the IA Program and 23CFR637, Section 6-102C(2) of the *Construction Manual* instructs the construction engineer that:

All acceptance testers require certification. No tests or samples are to be taken on Caltrans projects unless the tester is certified in the test being performed.

1.2 IA PROGRAM ROLES AND RESPONSIBILITIES

Roles and responsibilities are divided between the METS and the districts. In general, METS IA staff is responsible for program development, implementation, and oversight; maintenance of the reference sample program; certification of district IA staff; record keeping; and review and accreditation of METS laboratories and technicians. District IA staff is responsible for technician qualification, laboratory accreditation, and record keeping. The roles and responsibilities are more specifically outlined on the following pages.

1.2.1 METS ROLES AND RESPONSIBILITIES

METS has overall responsibility for directing and managing the Independent Assurance Program to include the following:

1. Developing and Maintaining the Independent Assurance Manual

The Independent Assurance Manual was approved and signed by the FHWA in November 2006. FHWA continues to participate in reviewing and evaluating the IA Program and IA Manual. In 2009, there are plans to update the current IA Manual.

2. Training and Certifying District IA Staff

District staff applying to be certified as district IA staff must attend a two-day training course conducted by METS IA staff. The two-day course includes: written examinations on the *Independent Assurance Manual*, the IA process and randomly chosen test methods; and training in the most recently revised test methods. In addition, district staff may be witnessed while performing some of the tests they will be qualifying technicians to perform. Upon successful completion of all parts, the new district IA staff is issued a certificate valid for one year.

To maintain certification, district IA staff is required to attend an annual one-day refresher course, successfully complete a METS review of the district IA records, and pass written examinations and performance evaluations (witnessing) of some of the test methods that they will be qualifying technicians to perform.

The 2008 Annual Meeting was held on December 2 and 3, 2008. Issues such as: AASHTO accreditation, local assistance independent assurance, district IA practices and continued implementation of the new hot mix asphalt specifications were discussed.

3. IA Process and Peer Review

Annually, a process/peer review will be performed to verify district compliance with Caltrans policies regarding independent assurance. The review will consist of an examination of IA documents, records and procedures. METS staff will perform the reviews of the district IA Program implementation. These reviews will promote statewide uniformity for the Caltrans IA program.

Districts were reviewed in conjunction with the yearly IA recertification sessions.

4. Developing and Maintaining the Statewide Database of IA Staff

Districts maintain centralized records of technicians and laboratories, and METS always has access to those records. However, there has been an increased need for a centralized statewide database.

METS has been working with Caltrans' Information Technology (IT) group to develop and implement an interactive statewide database of technician qualification and laboratory accreditation data. This database is comprehensive, providing historical as well as current information to both the districts and METS. The database was completed in June 2008. Training was provided to the district IA staff in June 2008. Minor modifications to the existing program are required and will be implemented in conjunction with Caltrans' IT group. These modifications will be made in early 2009 and full deployment of the webpage is planned for early 2009.

5. Qualifying Technicians and Accrediting Laboratories Within METS

METS IA staff provides qualification for METS technicians that perform quality assurance testing for construction projects. This involves technicians from the hot mix asphalt, asphalt binder, emulsions, aggregate, cement, portland cement concrete, soils, and source inspection units.

METS IA staff provides accreditation for METS laboratories that perform quality assurance testing for construction projects. In addition, METS' hot mix asphalt, asphalt binder, aggregate, cement, portland cement concrete, and soils laboratories, as required by 23CFR637, are accredited by the AASHTO Accreditation Program. It is the responsibility of METS IA staff to maintain technician qualifications, laboratory accreditation, and equipment calibration for the hot mix asphalt, asphalt binder, aggregate, concrete, cement, and soils testing laboratories such that both Caltrans Independent Assurance and AASHTO standards are maintained.

6. Calibrating Large Equipment for Caltrans and Local Agency Testing Laboratories

METS IA staff provides calibration services for all large equipment within districts, METS laboratories and local agency laboratories. A METS IA staff person annually calibrates all compactors, presses, and related equipment.

7. Managing Reference Samples— Sample Preparation and Data Evaluation

Caltrans uses its own set of test methods that are specifically tailored for the testing needs of the state and its construction acceptance program. These test methods are different from, but are most often closely related to, existing ASTM and AASHTO test methods, and therefore require separate statistical analysis. For this reason, the Caltrans Reference Sample Program (RSP) was developed to evaluate the performance of California laboratories as well as gather more information on the variability and bias of the California Test Methods within the state.

The *Independent Assurance Manual* outlines a process by which samples of soil, aggregate, concrete, and hot mix asphalt are periodically sent to participating laboratories. Statistical analysis of the test results is used to score each laboratory within the general population. Good standing with regard to reference sampling is a

requirement for laboratory accreditation. In addition, data from these reference samples can be used to quantify variability between laboratories to identify precision and bias of particular test methods.

The Reference Sample Program sent out proficiency samples to participating laboratories in fine aggregate, PCC and soil in 2008.

8. Consultation and Dispute Resolution

METS IA staff provides consultation and dispute resolution in assistance to the Districts. METS IA staff answers technical questions regarding test methods and testing equipment.

9. Maintaining Equipment Standardization

Since 2002, METS has been instrumental in providing funding for testing equipment for district materials laboratories and district construction field laboratories throughout the state. These funds have enabled the districts to purchase new laboratory equipment such as presses, kneading compactors, ovens and shakers. METS is moving towards statewide testing equipment uniformity.

In support of the implementation of the new Section 39, "Hot Mix Asphalt" specifications, METS has purchased equipment for the statewide District Materials Laboratories. This ensures consistency in testing equipment for all districts.

1.2.2 DISTRICTS ROLES AND RESPONSIBILITIES

Districts have responsibility for the following:

1. Implementing and Administering the IA Program at a District Level

The IA Program in each of the districts is the direct responsibility of the District Materials Engineer (DME), a senior-level engineer and supervisor of some portion, if not all, of the district's materials program. Depending on district or region structure, these DMEs are managed by either the Division of Engineering Services or the Division of Construction.

At the project level, the Caltrans quality assurance process requires that only qualified technicians and accredited laboratories provide test results on which acceptance decisions are based.

On the district level, IA staff provide: annual qualification of technicians; annual accreditation of laboratories; review of calibration records for testing equipment; corroboration samples and evaluation of the results; district IA file maintenance; and disqualification of technicians and laboratories, as appropriate.

In addition, District IA staff can be called upon to serve for dispute resolution in on-going projects if questions arise about testing procedures. The specification for hot mix asphalt offers the district IA staff as one of the alternatives for dispute resolution.

2. Qualifying Caltrans, Public Agency, and Private Technicians, and Accrediting Laboratories

District IA staff is responsible for the annual qualification of technicians and accreditation of laboratories that provide testing for Caltrans and some local agencies for or on federal-aid highway projects. Technician qualification requires successful completion of a written and practical examination for each test method performed and is valid for one year. According to the *Caltrans Independent Assurance Manual*, yearly corroboration samples are required to maintain a valid qualification in the following test methods:

- CT 202, "Method of Tests for Sieve Analysis and Absorption of Fine Aggregates"
- CT 217, "Method of Test for Sand Equivalent"
- CT 227, "Method of Test for Evaluating Cleanness of Coarse Aggregate"

All qualified technicians must be associated with a laboratory accredited by Caltrans. Technician qualification may be carried across district boundaries as long as the technician is affiliated with the same accredited laboratory under which the original qualification was issued.

Laboratory reviews are conducted annually. Laboratory reviews include a review of safety procedures and conformance with the Caltrans Laboratory Accreditation Manual. The Laboratory Accreditation Manual must contain the following documents:

- Organization chart
- Personnel qualifications
- Laboratory affiliations
- Reference sample records
- Test procedures
- Equipment maintenance and calibration records

METS provides calibration services for large laboratory equipment located in the districts and local agencies. Private laboratories are required to use private calibration services.

District IA staff is responsible for disqualifying technicians and suspending accreditation for laboratories that do not meet the standards of the Caltrans IA Program. The process for disqualification of technicians and laboratories is fully detailed in the *Independent Assurance Manual*.

3. Maintaining Records

Technician qualification requires successful completion of a written and practical examination for each test method and it is valid for one year. District IA staff maintains all records relating to the qualification process including the passing and failing status of both written and practical examinations for each technician, laboratory reviews, and disqualifications.

In 2008, METS IA staff conducted process reviews for the districts. One of the items reviewed are the IA files to ensure they are in accordance with the requirements of the IA Manual.

Shown in Table 1 are the records maintained by METS and district IA staff. Records are to be kept a minimum of three years.

TABLE 1: INDEPENDENT ASSURANCE RECORDS

CATEGORY	ITEM
100	Form TL-0100, IA Certificate of Completion Form TL-0108L, Master List of Caltrans Accredited Laboratories Form TL-0108T, Master List of Caltrans Qualified Testers
200	Calibration Records Form TL-0112, Inventory of Materials Testing Equipment
300	Caltrans Tester Records ▪ Tester records, including: Form TL-0110, Independent Assurance Log Summary Sheet Form TL-0111, Tester Certificate of Proficiency ▪ Witness and corroboration forms, including: Form TL-0103, Report of Witness Test Form TL-0104, Corroboration Report Form Form TL-0107, Corroboration Test Form
400	Non-Caltrans Tester Records ▪ Tester records, including: Form TL-0110, Independent Assurance Log Summary Sheet Form TL-0111, Tester Certificate of Proficiency ▪ Witness and corroboration forms, including: Form TL-0103, Report of Witness Test Form TL-0104, Corroboration Report Form Form TL-0107, Corroboration Test Form
500	Qualification of Laboratories: Laboratory Qualification Binders Form TL-0113, Caltrans Accredited Laboratory Inspection Report
600	Copies of Reference Sample Reports

2. CALTRANS INDEPENDENT ASSURANCE PROGRAM IN 2008

Shown in Table 2 is a summary of certified Caltrans IA staff, qualified technicians, and accredited laboratories by district for 2008.

Table 2: Tester and Laboratory Data 2006, 2007 and 2008

Dist	Certified IA Staff			Number of Qualified Technicians			Accredited Laboratories											
							Caltrans			Local Agencies			Private Industry			Total		
	08	07	06	08	07	06	08	07	06	08	07	06	08	07	06	08	07	06
1	2	2	2	66	65	30	11	12	9	2	0	1	0	2	3	13	14	13
2	3	2	3	155	77	84	8	14	19	1	1	1	9	5	6	18	20	26
3	3	3	3	124	146	135	13	9	9	2	0	1	25	10	10	40	19	20
4	5	5	5	558	577	760	32	6	7	3	3	1	7	18	31	42	27	39
5	1	1	1	139	98	94	10	9	10	2	3	3	13	8	9	25	20	22
6	2	2	2	239	250	196	5	6	5	2	3	3	25	17	15	32	26	23
7	4	4	3	217	235	223	1	1	14	0	0	2	15	15	12	16	16	28
8	3	4	4	417	336	301	5	5	5	2	2	1	37	29	33	44	36	39
9	2	1	1	45	38	35	2	2	2	0	0	0	4	4	4	6	6	6
10	2	1	1	176	361	231	3	7	7	0	1	0	15	25	20	18	33	27
11	2	2	2	150	194	145	14	28	19	2	1	2	20	27	22	36	56	43
12	2	2	2	225	281	252	4	4	4	1	1	1	20	22	22	25	27	27
Total Dist	31	29	29	2511	2658	2486	108	103	110	17	15	16	190	182	187	315	300	313
HQ	1	1	1	47	47	25	7	6	4	0	0	0	0	0	0	7	6	4
Total	32	30	30	2558	2705	2511	115	109	114	17	15	16	190	182	187	322	306	317

2.1 INDEPENDENT ASSURANCE STAFF CERTIFICATION

In 2008, two new district IA staff were certified to assist with increased workload in their districts. By the end of 2008, two existing district IA staff left their positions. The replacement staff will be certified in 2009.

New IA staff work with experienced district IA staff until they are fully able to perform all the duties. The METS IA staff pays particular attention to new district IA staff to insure that the Caltrans IA standards are being maintained.

2.2 ANNUAL RECERTIFICATION OF STATEWIDE IA STAFF

METS IA staff visited the districts to recertify staff and conduct process reviews. METS IA staff recertified 29 district IA staff in all 12 districts. Topics covered during recertification were as follows:

- Review of Caltrans Lab Procedures 1 through 9:
- Written exams in the above lab procedures, with emphasis on the calculations required in the test methods

2.3 2008 INDEPENDENT ASSURANCE ANNUAL MEETING

The IA Annual Meeting was held in December 2008. METS, district IA staff and the District Materials Engineers were in attendance. Attendance by district IA staff is mandatory for IA recertification. District IA staff that do not attend are required to attend a make-up session. The make-up session will be held in early 2009.

The following topics were covered:

- Overview of IA program in 2008
- Equipment calibration
- 2008 Reference Sample Program
- AASHTO accreditation for the District Materials Laboratories
- IA staff for local agency support
- Changes in Caltrans standard specification for hot mix asphalt
- District IA issues
- District IA training programs

2.4 DISTRICT IA PROCESS AND PEER REVIEWS

The *Independent Assurance Manual* requires an annual process/peer review to verify district compliance with Caltrans policies regarding independent assurance. The review consists of an examination of IA documents, records and procedures. METS IA staff conducts the review of the district IA program implementation. These reviews are intended to promote statewide uniformity in the Caltrans IA Program.

All twelve districts were reviewed by METS IA staff in 2008. In general, all districts have improved their file systems. METS IA staff will continue to conduct process reviews in 2009.

2.5 TECHNICIAN QUALIFICATION

District IA staff and METS IA staff qualified a total of 2558 technicians in Caltrans, local agency and commercial laboratories in 2008. This is a decrease from the 2705 technicians accredited in 2007.

2.5.1 TECHNICIAN DISQUALIFICATIONS

Five technicians were disqualified by district IA staff due to use of improper test procedures. In one of the districts, the District Materials Engineer granted the appeals and two of the technician's qualifications were reinstated. In the other cases, no dispute resolution was requested.

2.6 WRITTEN EXAM AND PRACTICAL STATISTICS

The 2008 data provided for the written exams and practical exams is shown in Table 3.

TABLE 3: 2008 EXAM STATISTICS FOR ALL DISTRICTS AND METS

	WRITTEN EXAMS				PRACTICAL EXAMS				WITNESS FOR RECERTIFICATION			
DIST.	TOTAL EXAMS	% FAIL 1ST TIME	% FAIL 2ND TIME	% FAIL 3RD TIME	TOTAL EXAMS	% FAIL 1ST TIME	% FAIL 2ND TIME	% FAIL 3RD TIME	TOTAL EXAMS	% FAIL 1ST TIME	% FAIL 2ND TIME	% FAIL 3RD TIME
1	**245**	17%	2%	0%	**203**	1%	0%	0%	**265**	0%	0%	0%
2	**694**	16%	1.6%	0%	**595**	3%	5	0%	**466**	<1%	0%	0%
3	**402**	35%	9%	0%	**229**	7%	0%	0%	**732**	5%	0%	0%
4	**2057**	9%	8%	28%	**1454**	4%	0%	0%	**1198**	3%	0%	0%
5	**446**	30%	22%	26%	**267**	8%	0%	0%	**308**	3%	0%	0%
6	**1548**	19%	15%	11%	**1830**	6%	11%	13%	**463**	<1%	0%	0%
7	**1055**	23%	25%	18%	**491**	<1%	0%	0%	**1171**	1%	0%	0%
8	**1846**	15%	17%	14%	**868**	2%	<1%	0%	**1925**	<1%	0%	0%
9	**234**	23%	19%	11%	**191**	5%	<1%	0%	**341**	<1%	<1%	0%
10	**925**	18%	1%	0%	**767**	1%	28%	0%	**1416**	<1%	0%	0%
11	**780**	27%	24%	0%	**300**	20%	0%	0%	**401**	15%	0%	0%
12	**706**	30%	22%	6%	**404**	10%	0%	0%	**477**	<1%	0%	0%
METS	**63**	20%	8%	0%	**63**	7%	0%	0%	**302**	8%	0%	0%

The percentages are computed as illustrated in the following example:

In District 2, there were 694 written exams taken by technicians. Out of those exams, 108 were failures the first time. (108/694 = 15.5%) In the second attempt, 1 failed the second time. (1/62 = 1.6%). In the third attempt, there were no failures.

As shown in the data, the major hurdle in the technician qualification process is passing the written exam. In the 2008, the passing rate was 70%. In comparison the failure rates in 2007 (shown in Table 4), failure rates have decreased in 2008. It appears that the lower passing score and increased time between retests have contributed to decreased failure rates.

TABLE 4: 2007 EXAM STATISTICS FOR ALL DISTRICTS AND METS

DIST.	WRITTEN EXAMS				PRACTICAL EXAMS				WITNESS FOR RECERTIFICATION			
	TOTAL EXAMS	% FAIL 1ST TIME	% FAIL 2ND TIME	% FAIL 3RD TIME	TOTAL EXAMS	% FAIL 1ST TIME	% FAIL 2ND TIME	% FAIL 3RD TIME	TOTAL EXAMS	% FAIL 1ST TIME	% FAIL 2ND TIME	% FAIL 3RD TIME
1	243	14%	13%	0%								
2	393	10%	4%	0%	334	5%	1%	0%	604	3%	33%	20%
3	293	44%	32%	0%	154	3%	0%	0%	354	1%	0%	0%
4	840	8%	9%	0%	701	3%	0%	0%	1050	3%	3%	0%
5	434	23%	11%	27%	271	8%	0%	0%	317	5%	0%	0%
6	1981	19%	18%	33%	1736	4%	8%	0%	395	2%	0%	0%
7	1195	20%	30%	27%	614	<1%	0%	0%	1008	<1%	0%	0%
8	1997	18%	20%	43%	910	5%	1%	0%	1724	<1%	3%	0%
9	218	21%	17%	9%	172	6%	2%	0%	312	<1%	0%	0%
10	892	4%	14%	28%	892	2%	0%	0%	175	0%	0%	0%
11	1042	11%	18%	0%	800	13%	50%	0%	2841	1%	0%	0%
12	647	29%	26%	25%	243	6%	0%	0%	636	<1%	0%	0%
METS	63	20%	8%	0%	63	7%	0%	0%	302	8%	0%	0%

2.6.1 PRACTICAL EXAMS FOR TECHNICIAN QUALIFICATION

In analyzing the data for the practical exams, the failure rate is lower. Failure to pass the practical examination will occur if improper test equipment is presented, if an uncorrected error in proper test procedure occurs while demonstrating the test procedure, or if the technician fails to complete the paperwork or calculations correctly. An issue for further consideration in the development of the IA Program is to develop a standardized method for the practical examination evaluation where distinct pass/fail criteria are developed.

2.7 LABORATORY ACCREDITATION

In 2008, METS IA and district IA staff accredited a total of 322 Caltrans, local agency and commercials laboratories. This is an increase from the 306 laboratories accredited in 2007.

2.7.1 LABORATORY ACCREDITATION REVOKATION AND DISPUTE RESOLUTION

Section 2.5, "Dispute Resolution" of the *Caltrans Independent Assurance Manual* states:

"A tester or laboratory my have its entire qualification or accreditation or its qualification or accreditation for specific test methods suspended or revoked if it is found not to conform to IA accreditation requirements."

In 2008, no laboratories had their accreditation revoked.

2.8 CALTRANS LABORATORIES—EQUIPMENT AND CALIBRATION

Since 2002, METS has been instrumental in providing funding for testing equipment for the District Laboratories and Construction field laboratories throughout the state. Funding was provided by METS to the districts again in 2008 to purchase laboratory equipment for the implementation of the new hot mix asphalt specification.

2.8.1 PROPER CALIBRATION OF TESTING EQUIPMENT

METS IA staff calibrate all large testing equipment for the districts. In addition, METS IA staff performs calibration of presses and compactors on an annual basis. This ensures that all Caltrans large testing equipment is being calibrated uniformly.

In 2008, METS IA staff calibrated large equipment in 13 Caltrans and 16 local agency laboratories.

For smaller equipment, district IA staff is responsible for verifying the calibration of all testing equipment in accredited field laboratories. Some districts IA staff are responsible for calibration of equipment in the district and field laboratories, while other districts review the calibration records for district and field laboratories. In these districts, smaller testing equipment is calibrated by private calibration services. This is mainly a resource issue in each district. Overall, all calibration records are reviewed by district IA staff, whether they are directly responsible for calibration of the equipment or not. The *Independent Assurance Manual* covers calibration procedures for equipment such as larger presses and scales.

2.9 CALTRANS REFERENCE SAMPLE PROGRAM (RSP) IN 2008

The *Independent Assurance Manual,* Section 2.4.4, "Proficiency Testing" states,

"The laboratory shall participate in all required proficiency sample programs to be accredited."

It is the laboratory's responsibility to maintain active status in proficiency testing of reference samples by testing and reporting the results.

Reference sample results are evaluated using a statistical evaluation system for determining the numerical ratings of each test method. The statistical evaluation method uses the standard deviation from the mean for a given test method as indicated below:

TABLE 6: RATING SYSTEM FOR THE REFERENCE SAMPLE PROGRAM

STATISTICAL VALUE	NUMERICAL RATING	INTERPRETATION OF RESULTS
$X \pm 1.0\ \sigma$	5	Acceptable (Very Good)
$X \pm 1.5\ \sigma$	4	Acceptable (Good)
$X \pm 2.0\ \sigma$	3	Acceptable (Fair)
$X \pm 2.5\ \sigma$	2	Unacceptable (Poor)
$X \pm 3.0\ \sigma$	1	Unacceptable (Very Poor)

If a rating score less than 3.0 is received for any test method performed, the laboratory is required to examine its equipment and/or test procedures to determine why the test result varied appreciably from the mean of the test results obtained by other laboratories. A second sample of material will then be shipped to the laboratory for retesting.

If the results of the second test are acceptable and the causes leading to the original deficiency are corrected and documented, the initial unacceptable rating is considered resolved.

If the results of the second material sample are once again below a 3.0 rating, the individual laboratory must contact IA staff for assistance. A third sample may be run with district IA staff witnessing the testing procedures. Unacceptable ratings, if uncorrected, will result in the loss of laboratory accreditation.

In 2008, samples of fine aggregate, portland cement concrete aggregate and soil were distributed to participating laboratories.

A full report for the 2008 Fine Aggregate Reference Sample Program is located in Appendix A.

2.9.1 GOALS FOR REFERENCE SAMPLE PROGRAM IN 2009

The following table gives an approximate timeline for the 2009 reference sample program:

2009	Sample Type
First quarter	Coarse Aggregate Samples
Second quarter	Soil Samples
Third quarter	Hot Mix Asphalt Samples

2.10 STATEWIDE DATABASE OF TECHNICIAN QUALIFICATION AND LABORATORY ACCREDITATION

In 2008, METS and Caltrans' IT group developed and implement an interactive statewide database of technician and laboratory accreditation data. This database is comprehensive, providing historical as well as current information to both the districts and METS. Database training was held in June 2008.

The database is web–enabled and available to Caltrans and the public. The database will assist the District and METS IA staff in maintaining a statewide, comprehensive and up to date list of qualified technicians and accredited laboratories. This will allow all the districts to view each other's information as well as allow METS to monitor the overall effectiveness of the program. It will assist METS in summarizing and analyzing data for future annual reports. In addition, the database will assist Construction in accessing up to date technician qualification and laboratory accreditation status.

2.11 NUCLEAR GAGE TEST METHODS MODIFICATION

In 2008, METS IA staff, District IA staff and District Radiation Safety Officers continued to work on modifying the following test methods:

- CT 111, "Developing Density and Moisture Calibration Tables for the Nuclear Gage"
- CT 121, "Use of Nuclear Gages"
- CT 231, "Relative Compaction of Untreated/Treated Soils and Aggregates (Area Concept Utilizing Nuclear Gages)"
- CT 375, "Determining the In-Place Density and Relative Compaction of Hot mix asphalt Pavement"
- CT 552, "Method of Test for Relative Compaction of Polymer Concrete Utilizing Nuclear Gages"

These are all test methods that deal with calibration of nuclear gauges. In short, these test methods are being updated to reflect the current national state of practice for nuclear gauge calibration. In addition, the language in these test methods will be modified for consistency between test methods.

Final drafts of these test methods were in the process of final review in 2008, with a goal of implementation for mid-2009.

2.12 CALTRANS TEST METHOD UPDATES

To address the need for updating Caltrans Test Methods and to coordinate the changes in test methods resulting from the implementation of the new hot mix asphalt specification, three expert working groups (EWG) were formed. These technical working groups include members of industry and Caltrans. District IA staff are members of these

technical working groups. The purpose of these groups is to update the current Caltrans test methods to reflect state of the art practices in the hot mix asphalt field.

The groups are as follows:

- Hot Mix Asphalt EWG (HMAETG): deals with all test methods related to hot mix asphalt
- Aggregate TWG (AETG): deals with all test methods related to aggregate for hot mix asphalt
- Other: deals with test methods not in the other categories that related to hot mix asphalt

These task groups are expected to complete the test method modifications in early 2009.

2.13 LOCAL AGENCY INDEPENDENT ASSURANCE PROGRAM

Local Agencies and the Caltrans IA Program

Chapter 16, Section 16.14, "Quality Assurance Program," of the Caltrans Local Assistance Procedures Manual, states **local agencies must follow Caltrans Quality Assurance Procedures (QAP) for all projects on the NHS**. Therefore, for local agency projects on the NHS, Caltrans IA staff is responsible for providing IA services to local agencies.

In the past, problems regarding IA services have been encountered with non-NHS local projects that are federally funded. Non-NHS projects administered by local agencies are required to prepare a QAP manual. The QAP manual may specify Caltrans Test Methods, ASTM or AASHTO test methods. If Caltrans test methods are specified, then the local agency laboratory (or a private laboratory contracted by the local agency) must be accredited in Caltrans test methods

Since the districts administer the implementation of the IA support for local agencies, there have been inconsistencies between the districts regarding the level of service a local agency receives when requesting IA services for a non-NHS project. Local agencies and the consultants who service them have found the lack of consistent IA services from the districts frustrating.

FHWA conducted process reviews of local agency projects in 2004 and 2007, and found tester qualification, laboratory accreditation, and IA services lacking in the majority of projects. FHWA expressed concern that all of the agencies reviewed were not keeping IA services separated from the QA services. They have recommended that Local Programs make changes to improve that situation.

A Budget Cost Proposal (BCP) was prepared by the Caltrans Division of Local Agencies to provide a permanent increase in positions to handle an increased workload due to FHWA requirements. Part of that BCP allowed for a permanent increase of 5 positions to

provide IA services for all local agency construction projects. This increase provided a mechanism to allow Caltrans to perform Caltrans IA services on local agency projects and provide a uniform process for IA services throughout the state.

Five positions were transferred between the Division of Local Agencies and the Division of Engineering Services to assist DES in providing Caltrans IA services to local agency for qualifying testers and accrediting laboratories.

These positions will be responsible for providing Caltrans IA services to local agencies to the standards established in the Caltrans Independent Assurance Manual.

Scope of Work

The personnel responsible for providing IA services will be physically located in areas throughout the state where the resources are most required. They will be headquartered out of DES – METS in Sacramento.

The METS local assistance IA staff will provide Caltrans IA services to local agencies once the following requirements are met:

- The local agency must have an approved QAP on file with the District Local Assistance Engineer (DLAE). The QAP must require the use of California Test Methods. Caltrans IA staff is not responsible for accreditation in ASHTO and ASTM test methods.
- The DLEA must provide a copy of the QAP to the METS local assistance IA staff.
- If a private laboratory is hired to provide testing services for a local agency, the local agency must have a written agreement between the private laboratory specifying the scope of work. A copy of the written agreement and scope of work must be provided to the METS local assistance staff.
- The local agency lab (or designated private testing lab) must participate in the Caltrans Reference Sample Program (RSP). A copy of the RSP questionnaire must be provided to the METS local assistance IA staff.

Upon receipt of these documents, METS local assistance IA staff will provide Caltrans IA services as outlined in the Caltrans IA Manual. These services will include, but not be limited to, the following:

- Laboratory accreditation
- Tester qualification
- Review of calibration records for testing equipment
- IA file related maintenance
- Disqualification of technicians and laboratories, as appropriate

Local agency IA staff will interact on a regular basis with the district local assistance engineer (DLAE).

These positions were filled in December 2008. Implementation of the program will begin in early 2009.

3. CALTRANS INDEPENDENT ASSURANCE PROGRAM—SHORT-TERM AND LONG-TERM GOALS

3.1.1 SHORT-TERM GOALS

Independent Assurance Manual Revisions

As a result of lessons learned from the implementation of the 2005 *Independent Assurance Manual,* changes are needed to the current manual. Revisions to the manual are planned for 2009.

AASHTO Accreditation of the District Materials Laboratories

The State Materials Engineer for Caltrans has determined that central materials testing labs in each district need to be AASHTO accredited within six years. This will be done in a joint effort between the Districts and the Office of Flexible Pavement.

The specific labs are:

- The central materials testing labs in Districts 1, 2, 3, 4, 5, 6, 9, 10, and 11
- The planned southern regional testing lab in District 7

It is estimated to take 3 years to get an individual lab accredited. The accreditation schedule for each lab is in development stage.

In 2009, the scope of accreditation will be determined. In addition, the additional equipment needed to perform AASHTO tests will also be developed. METS IA will also assist in determining how the current IA program can meet AASHTO requirements.

3.1.2 LONG-TERM GOALS

Caltrans is committed to continue the program as currently structured. Given the level of work required, the Department's first choice is to continue the work using state forces. However, due to increased transportation funding workloads will increase. Understanding the need to fulfill the greater demands of the IA Program, the Department is looking into alternatives to continue the program as currently structured. These alternatives include using a third party to qualify local agency and private technicians.

In 2007, a report was prepared through a Mactec consultant contract to evaluate the current IA Program structure. In 2008, the Office of Flexible Pavement has been

working with Industry to implement the report recommendations. This effort is on-going for 2009.

For additional information and/or clarification on this report, please contact Cathrina Barros, Statewide Coordinator of the Caltrans IA Program, at (916) 227-7181 or via e-mail sent to <cbarros@dot.ca.gov>, or Terrie Bressette, Chief of the Office of Flexible Pavement Materials, at (916) 227-7303 or via e-mail sent to <terrie_bressette@dot.ca.gov>.

4. APPENDIX A: RSP REPORT FOR 2008

REFERENCE SAMPLING PROGRAM

FINE AGGREGATE

2008 PROFICIENCY TEST RESULTS

State of California Department of Transportation

Office of Flexible Pavement Materials

Division of Engineering Services

Materials Engineering and Testing Services-MS #5

5900 Folsom Blvd

Sacramento, California 95819-4612

November 24, 2008

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REFERENCE SAMPLING PROGRAM

FINE AGGREGATE - 2008 PROFICIENCY TEST RESULTS

5. OVERVIEW

The 2008 fine aggregate proficiency tests started in early 2008 and include three California tests (CT) as below:

- **CT 202 – Sieve Analysis of Fine and Coarse Aggregates**
- **CT 207 – Specific Gravity and Absorption of Fine Aggregate**
- **CT 217 – Sand Equivalent**

Nearly 200 labs participated in these tests. Test results were received in May and analyzed in accordance with Caltrans Independent Assurance Program Manual. For labs failed to achieve an acceptable score in the initial test, an additional sample of material was sent to the individual labs for a retest. This report presents test results from both the initial test and the retest.

6. ANALYSIS OF TEST RESULTS

6.1 EVALUATION CRITERIA

Test results were analyzed using a statistical evaluation system in which the means (X) and standard deviation (s) were calculated for each test parameter. A rating score was then given to the test result based on the criteria shown in Table 1. A test result with a score of 3 or greater was considered acceptable. A test result with a score of 2 or less was considered unacceptable and a retest was required.

Table 1. Evaluation Criteria

Test Result	Rating	Interpretation of Results	Acceptance
X ± 1.0s	5	Very Good	Acceptable
X ± 1.5s	4	Good	
X ± 2.0s	3	Fair	
X ± 2.5s	2	Poor	Unacceptable
X ± 3.0s	1	Very Poor	

For CT 202, a final score was determined based on the lowest score from one the sieve sizes: No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, or No. 200. For CT 207, bulk specific gravity and percent of moisture absorption were treated as two separate test parameters. If one of the two or both test parameters failed to achieve an acceptable score, a retest was required.

6.2 INITIAL TEST

A total of 195 laboratories participated in the initial test. An analysis of outlier conducted by following ASTM E 178 indicated that the test results from some of the labs were possible outliers as summarized in Table 2.

Table 2. Labs whose Test Results were considered as Outliers

CT	# of Outlier	Lab ID
202	16	6, 50, 56, 95, 123, 235, 244, 265, 274, 289, 296, 348, 349, 366, 401, 405
207	4	145, 149, 359, 364
217	2	123, 219

After removing the outliers, the mean value and standard deviation for each test parameter were re-calculated for determining the score for the respective test parameter. The analysis results are presented in Table 3. Detailed test results are provided in Appendix A.

Table 3. Summary of Initial Test Results

Item	# Lab	Average	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 202								
No. 4	179	100	0.1	179	0	0	0	0
No. 8	179	86.4	1.1	116	53	0	7	3
No. 16	179	73.3	1.3	116	42	14	0	7
No. 30	179	49.4	1.7	146	9	11	7	6

No. 50	179	25.6	1.7	155	5	6	4	9
No. 100	179	16.0	0.8	98	72	0	5	4
No. 200	179	14.4	0.9	137	0	38	0	4
Final Score	179			47	52	43	14	23
% of Total	100			26.3	29.1	24.0	7.8	12.8
CT 207								
BSG	108	2.61	0.07	78	16	6	7	1
% of Total	100			72.2	14.8	5.6	6.5	0.9
% Absorption	108	2.2	1.1	76	19	8	2	3
% of Total	100			70.4	17.6	7.4	1.9	2.8
CT 217								
SE	192	73.0	3.1	155	13	14	4	6
% of Total	100			80.7	6.8	7.3	2.1	3.1

6.3 RETEST

A total of 81 laboratories participated in the retest of various California Tests for which they have not received an acceptable score in the initial test. The retest was conducted during July 2008. There were 69 labs participated in both the initial test and the retest. 12 labs did not participate in the initial test but participated in the retest; they were labs with ID number of 2, 10, 47, 122, 160, 177, 192, 302, 310, 383, 444, and 526.

There was no outlier in the test results. For the labs that submitted test results, mean value and standard deviation for each test parameter were calculated as presented in Table 4. The means and the standard deviation were used in the t-test to determine if the means between the initial test and the retest were statistically same at 95% confidence level. The answer was yes. The score of each test parameter was determined by comparing the retest result with the rating range from the initial test. Detailed test results are provided in Appendix B.

Table 4. Summary of Retest Results

Item	# Lab	Average	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 202								
No. 4	53	100	0.0	53	0	0	0	0
No. 8	53	86.3	0.9	39	14	0	0	0
No. 16	53	73.3	1.1	39	9	4	0	1
No. 30	53	49.3	1.9	40	5	2	2	4
No. 50	53	24.8	1.5	45	1	3	1	3
No. 100	53	15.6	1.1	29	17	0	4	3
No. 200	53	13.7	2.1	34	0	12	0	7
Final Score	53			15	13	13	3	9
% of Total	100			28.4	24.5	24.5	5.6	17.0
CT 207								
BSG	13	2.57	0.14	7	5	0	0	1
% of Total	100			53.8	38.5	0	0	7.7
% Absorption	24	2.4	0.8	19	3	1	1	0
% of Total	100			79.1	12.5	4.2	4.2	0
CT 217								
SE	27	73.3	2.8	23	2	1	0	1
% of Total	100			85.2	7.4	3.7	0	3.7

For labs that failed in the CT 202 initial test and took the CT 202 retest, 38 labs received an acceptable score; 10 labs (19, 31, 32, 50, 145, 235, 274, 289, 401, and 405) did not submit the test results; and 5 labs (90, 118, 265, 335, and 385) failed again to achieve an acceptable score.

For labs that failed in the CT 207 initial test (bulk specific gravity portion) and took the CT 207 bulk specific gravity retest, 5 labs received an acceptable score; 7 labs (27, 80, 145, 158, 212, 297, and 364) did not submit the test results. For labs that failed in the CT 207 initial test (moisture absorption portion) and took the CT 207 absorption retest, all 5 labs received an acceptable score.

For labs that failed in the CT 217 initial test and took the CT 217 retest, 11 labs received an acceptable score; one lab (401) did not submit the test results.

6.4 COMBINED RESULTS

A total of 207 labs participated in the fine aggregate reference sampling test. Table 5 shows combined results from both the initial test and the retest. Statistics are adjusted to reflect all test results.

Table 5. Summary of Combined Test Results

Item	# Lab	Average	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 202								
No. 4	232	100.0	0.1	232	0	0	0	0
No. 8	232	86.4	1.1	155	67	0	7	3
No. 16	232	73.3	1.3	155	51	18	0	8
No. 30	232	49.4	1.7	186	14	13	9	10
No. 50	232	25.4	1.7	200	6	9	5	12
No. 100	232	15.9	0.9	127	89	0	9	7
No. 200	232	14.3	1.3	171	0	50	0	11
Final Score	232			62	65	56	17	32
% of Total	100			26.7	28.0	24.1	7.3	13.8
CT 207								

BSG	121	2.61	0.08	85	21	6	7	2
% of Total	100			70.2	17.4	5.0	5.8	1.6
% Absorption	132	2.2	1.0	95	22	9	3	3
% of Total	100			72.1	16.7	6.8	2.2	2.2
CT 217								
SE	219	73.0	3.0	178	15	15	4	7
% of Total	100			81.4	6.8	6.8	1.8	3.2

6.5 OBSERVATIONS

There were a number of labs failed in the retest. Consequently, further tests were requested. To determine reasons for failures and help resolve any issues related to the tests, representatives from Caltrans visited these labs. The following observations were made:

- Improper test procedure was used
- Sieves were not calibrated
- Improper washing of the fine aggregate
- Insufficient amount of fine grading material was used (used 300 grams instead of approximately 500 ± 25 grams)
- Outdated stock solution was used
- Incorrect computation
- Sample was not thoroughly mixed prior to splitting
- Manually split (hand quarter) material without the use of a splitter (Lab was accredited with a splitter loaned from Caltrans)
- Did not re-run requested retest (accreditation was not completed)

7. SUMMARY

A total of 207 labs participated in the fine aggregate reference sampling test program. Of which, 195 participated in the initial test and 81 labs in the retest. 69 labs participated in both the Initial test and the retest; 12 labs participated in only the retest.

In the initial test, roughly 80% of the participating labs received an acceptable score in CT 202; about 93% received an acceptable score in CT 207 bulk specific gravity portion of the test; about

96% received an acceptable score in CT 207 absorption portion of the test; and about 95% received an acceptable score in CT 217.

In the retest, roughly 77% of the participating labs received an acceptable score in CT 202; about 92% received an acceptable score in CT 207 bulk specific gravity portion of the test; about 96% received an acceptable score in CT 207 absorption portion of the test; and about 96% receive an acceptable score in CT 217.

Combined statistics from both the Initial and the retest indicate that roughly 80% of the participating labs received an acceptable score in CT 202; about 93% received an acceptable score in CT 207 bulk specific gravity portion of the test; about 96% received an acceptable score in CT 207 absorption portion of the test; and about 95% received an acceptable score in CT 217.

Caltrans representatives visited labs that failed the retest and made observations on the testing process of subsequent test(s). Most of the issues were related to not following the requirements of each respective test method.

APPENDIX – A

Test Results from Initial Test
CT 202 - List of Laboratory Received a Final Score of 5

CT ID	# 4	# 8	# 16	# 30	# 50	# 100	# 200	Final Score
12	100	86	74	50	25	16	14	5
18	100	86	73	49	25	16	15	5
20	100	86	74	48	25	16	15	5
38	100	86	73	49	25	16	15	5
39	100	87	73	51	26	16	14	5
53	100	86	73	48	24	16	14	5
55	100	86	73	49	25	16	14	5
71	100	87	74	49	25	16	15	5
77	100	87	74	50	25	16	15	5
80	100	86	74	49	25	16	15	5
87	100	86	74	49	25	16	15	5
92	100	86	73	49	26	16	15	5
96	100	86	73	49	25	16	15	5
98	100	86	73	49	24	16	15	5
99	100	86	73	49	24	16	14	5
103	100	87	74	50	25	16	15	5
119	100	86	73	51	24	16	14	5
120	100	86	73	49	25	16	15	5
127	100	86	74	48	25	16	15	5
147	100	87	74	50	26	16	15	5
148	100	86	73	49	26	16	15	5
158	100	87	73	50	27	16	14	5
164	100	87	74	51	27	16	15	5

176	100	86	73	49	25	16	15	5
226	100	86	74	50	25	16	15	5
233	99	86	73	49	25	16	15	5
256	100	86	73	51	25	16	15	5
261	100	86	73	49	25	16	15	5
272	100	86	73	48	24	16	14	5
283	100	86	73	49	25	16	14	5
294	100	86	73	51	25	16	14	5
295	100	87	74	50	25	16	15	5
308	100	87	74	49	25	16	15	5
316	100	87	74	51	25	16	15	5
322	100	87	74	50	25	16	15	5
329	100	86	73	48	25	16	15	5
330	100	86	73	49	25	16	15	5
331	100	87	74	50	26	16	15	5
350	100	86	73	49	26	16	15	5
359	100	86	73	49	24	16	15	5
361	100	86	73	49	25	16	15	5
367	100	86	74	50	25	16	15	5
384	100	87	74	49	26	16	15	5
398	100	86	74	50	26	16	15	5
400	100	86	73	49	25	16	15	5
417	100	86	73	50	26	16	15	5
562	100	86	73	49	26	16	15	5

CT 202 - List of Laboratory Received a Final Score of 4

CT ID	# 4	# 8	# 16	# 30	# 50	# 100	# 200	Final Score
1	100	85	73	49	25	16	15	4
9	100	87	75	50	26	16	15	4
11	100	88	75	51	26	16	15	4
14	100	86	74	49	24	15	14	4
23	100	86	73	49	26	17	15	4
27	100	88	75	50	26	16	14	4
45	100	87	72	50	27	17	14	4
46	100	85	73	47	24	15	14	4
59	100	85	73	49	25	16	15	4
65	100	88	74	51	26	17	14	4
88	100	85	73	49	25	16	14	4
97	100	88	74	51	26	16	14	4
101	100	86	73	48	24	15	14	4
104	100	88	74	50	24	16	15	4
110	100	85	72	48	25	16	15	4
116	100	85	72	48	24	15	14	4
137	100	85	73	48	25	16	15	4
149	100	85	73	49	25	16	15	4
153	100	85	72	48	24	16	14	4
154	100	86	73	49	24	15	14	4
165	99	87	73	51	27	17	15	4
178	100	86	73	49	25	15	15	4
179	100	87	73	50	26	17	14	4
212	100	86	73	48	25	17	15	4
216	100	87	72	50	26	16	14	4

217	100	86	73	48	24	15	14	4
219	100	85	73	50	25	16	15	4
221	100	86	73	49	28	16	14	4
223	100	86	74	49	25	15	14	4
225	99	88	74	51	26	15	14	4
234	100	87	75	49	25	16	15	4
237	100	87	75	51	26	16	14	4
253	100	88	75	50	26	17	15	4
257	100	87	74	49	27	17	14	4
268	100	85	72	47	24	15	14	4
270	100	88	73	49	26	16	14	4
280	100	87	73	50	25	17	14	4
293	100	87	74	49	25	15	14	4
297	100	85	72	48	24	15	14	4
301	100	88	75	51	26	17	14	4
318	100	86	72	48	25	15	14	4
351	100	88	74	51	27	16	14	4
352	100	88	74	49	25	16	14	4
354	100	87	74	50	27	17	15	4
362	100	88	73	49	25	16	14	4
364	100	86	73	50	24	15	14	4
376	100	86	73	49	26	15	14	4
387	99	87	75	47	24	16	14	4
389	100	85	72	49	24	15	14	4
394	100	86	73	49	26	17	14	4
407	100	85	72	48	25	15	14	4
422	100	87	74	47	26	16	14	4

CT 202 - List of Laboratory Received a Final Score of 3

CT ID	# 4	# 8	# 16	# 30	# 50	# 100	# 200	Final Score
17	100	86	74	49	25	16	16	3
24	100	85	72	48	27	16	13	3
49	100	87	74	51	26	17	16	3
63	100	88	73	52	25	16	13	3
66	100	88	75	52	25	16	14	3
67	100	85	73	49	23	15	14	3
70	100	87	75	50	27	17	16	3
73	100	87	73	48	25	16	16	3
76	100	85	71	48	24	16	14	3
78	100	88	73	47	23	15	14	3
79	100	86	72	48	25	16	16	3
93	100	87	74	51	25	17	16	3
106	100	86	74	52	28	17	14	3
114	100	87	73	48	25	15	13	3
117	100	86	72	51	24	16	13	3
139	100	87	76	48	25	16	15	3
141	100	88	75	52	26	16	14	3
151	100	88	76	50	25	16	15	3
156	100	87	74	51	26	16	13	3
169	100	86	72	48	26	15	13	3
173	100	87	73	49	24	15	13	3
182	100	88	76	51	27	17	16	3
187	100	87	73	50	26	16	13	3
210	100	87	75	51	26	17	16	3
224	100	85	71	49	25	17	14	3

248	100	87	75	52	25	15	14	3
254	100	85	71	48	23	15	14	3
266	100	88	76	51	27	17	16	3
281	100	86	73	48	23	15	14	3
305	100	86	74	49	26	17	16	3
325	100	87	73	52	26	15	14	3
341	100	85	73	48	24	15	13	3
344	100	86	72	49	25	16	13	3
345	100	86	73	49	24	15	13	3
360	100	87	75	52	27	17	16	3
368	100	87	73	51	25	16	13	3
370	100	86	73	50	25	16	16	3
388	100	87	74	49	26	16	16	3
393	100	86	74	50	26	17	16	3
418	100	86	72	50	26	16	13	3
462	100	88	74	52	28	17	15	3
569	100	87	75	50	26	16	16	3
576	100	86	73	49	26	17	16	3

CT 202 - List of Laboratory Received a Final Score of 2 or 1

CT ID	# 4	# 8	# 16	# 30	# 50	# 100	# 200	Final Score
15	100	89	76	51	26	16	14	2
19	100	85	73	50	29	17	14	2
22	100	86	73	47	24	14	14	2
32	100	86	72	49	29	17	14	2
69	100	89	73	47	25	16	15	2
90	100	85	71	46	22	15	13	2
146	100	88	75	53	28	17	15	2
200	100	85	71	46	23	14	13	2
263	100	89	76	52	26	17	14	2
273	100	89	76	51	25	16	15	2
317	100	87	73	49	25	14	13	2
356	100	87	73	53	24	15	13	2
385	100	87	74	53	25	16	15	2
565	100	85	71	46	24	15	15	2
5	100	87	72	49	25	14	12	1
21	100	85	72	47	27	14	12	1
25	100	86	72	49	30	17	14	1
26	100	85	72	50	32	16	13	1
31	100	87	74	51	31	17	14	1
42	100	88	77	52	28	18	17	1
48	100	88	75	54	27	16	14	1
91	100	83	69	44	22	13	13	1
118	100	84	70	46	24	15	14	1
135	100	85	72	48	30	17	14	1
145	100	88	77	48	27	16	14	1

163	100	89	77	55	26	17	16	1
201	100	85	72	49	31	17	14	1
214	100	86	73	50	27	18	17	1
249	100	86	74	52	27	18	16	1
255	100	86	73	49	32	17	14	1
291	100	87	74	50	31	17	14	1
333	100	88	75	54	26	17	14	1
335	100	83	69	47	23	16	14	1
379	100	83	69	45	24	15	14	1
439	100	86	74	50	30	16	13	1
556	100	84	71	45	24	15	14	1
572	100	86	72	48	31	17	14	1

CT 202 - List of Laboratory being Considered as Possible Outlier

CT ID	No 4	No 8	No 16	No 30	No 50	No 100	No 200
6	100	87	74	50	33	16	15
50	100	86	74	49	25	7	16
56	100	86	72	45	23	15	7
95	100	88	77	54	28	19	18
123	100	86	69	45	19	12	7
235	100	85	73	50	25	6	4
244	100	88	75	53	29	20	16
265	100	87	75	51	46	16	14
274	100	87	74	50	25	16	5
289	99	785	73	49	26	16	14
296	100	90	79	54	26	17	15
348	100	100	74	50	26	16	13

349	100	86	72	50	24	13	8
366	100	87	76	5	28	19	18
401	100	85	71	45	21	13	8
405	100	87	74	49	25	169	14

CT 207 - List of Laboratory Received an Acceptable Score on Specific Gravity Test

CT ID	SG	Score	CT ID	SG	Score	CT ID	SG	Score
5	2.65	5	179	2.56	5	1	2.68	4
6	2.66	5	210	2.55	5	15	2.53	4
9	2.61	5	216	2.65	5	22	2.53	4
11	2.61	5	217	2.59	5	69	2.69	4
12	2.59	5	219	2.55	5	73	2.53	4
17	2.63	5	223	2.61	5	79	2.54	4
20	2.62	5	233	2.66	5	91	2.69	4
24	2.64	5	234	2.65	5	92	2.70	4
31	2.61	5	244	2.62	5	96	2.68	4
32	2.62	5	249	2.64	5	163	2.70	4
42	2.66	5	256	2.64	5	164	2.68	4
46	2.62	5	263	2.64	5	253	2.54	4
49	2.63	5	265	2.55	5	255	2.52	4
50	2.57	5	266	2.55	5	322	2.68	4
53	2.65	5	268	2.65	5	393	2.71	4
63	2.59	5	270	2.63	5	394	2.70	4
65	2.64	5	273	2.62	5	18	2.50	3
66	2.64	5	274	2.67	5	118	2.50	3
67	2.61	5	280	2.64	5	176	2.50	3
70	2.67	5	281	2.63	5	187	2.73	3
71	2.65	5	289	2.67	5	283	2.50	3
77	2.65	5	293	2.61	5	294	2.49	3
87	2.60	5	301	2.66	5			
88	2.61	5	316	2.65	5			

90	2.56	5	329	2.60	5			
95	2.66	5	331	2.67	5			
101	2.61	5	352	2.64	5			
106	2.67	5	354	2.66	5			
110	2.62	5	356	2.64	5			
114	2.63	5	361	2.65	5			
117	2.62	5	366	2.62	5			
119	2.67	5	370	2.57	5			
127	2.59	5	376	2.67	5			
135	2.62	5	385	2.67	5			
147	2.65	5	398	2.58	5			
154	2.63	5	400	2.65	5			
156	2.65	5	401	2.65	5			
165	2.63	5	562	2.58	5			
173	2.58	5	576	2.66	5			

CT 207 - List of Laboratory Received an Unacceptable Score on Specific Gravity Test

CT ID	SG	Score	CT ID	SG	Score	Outlier
27	2.45	2	59	2.41	1	
80	2.45	2	145	2.03	1	O
158	2.44	2	149	1.60	1	O
212	2.45	2	359	1.59	1	O
291	2.45	2	364	0.67	1	O
297	2.76	2				
565	2.45	2				

CT 207 - List of Laboratory Received an Acceptable Score on Absorption Test

CT ID	Abs	Score	CT ID	Abs	Score	CT ID	Abs	Score
5	1.9	5	164	1.3	5	1	0.8	4
6	1.6	5	165	1.4	5	42	1.1	4
9	1.7	5	173	1.9	5	63	0.7	4
11	3.1	5	179	3.1	5	66	0.9	4
12	3.2	5	212	2	5	92	0.9	4
15	3.2	5	217	2.8	5	101	1.1	4
17	2	5	223	2.7	5	106	0.9	4
18	2.8	5	233	2	5	145	1	4
20	1.5	5	234	1.6	5	187	0.7	4
24	2.4	5	244	2	5	216	0.9	4
27	3.2	5	249	1.9	5	255	3.7	4
32	2.9	5	253	2.1	5	268	1	4
46	3.1	5	256	2.2	5	281	0.9	4
49	2.7	5	263	1.63	5	283	3.6	4
53	1.9	5	265	2.4	5	294	3.7	4
65	2.6	5	266	2.6	5	352	1.1	4
67	2.9	5	270	1.6	5	366	0.6	4
69	1.2	5	273	1.8	5	385	1.1	4
70	1.5	5	274	2	5	393	1.1	4
71	1.3	5	280	1.58	5	398	1	4
73	3	5	289	1.4	5	31	3.8	3
77	2.6	5	291	1.2	5	50	3.8	3
79	1.4	5	293	2.1	5	90	4	3
80	1.4	5	297	2.6	5	158	3.9	3
87	2.2	5	301	1.3	5	176	3.8	3

88	1.3	5	316	2.2	5	210	4	3
91	1.6	5	322	1.5	5	370	4.1	3
95	1.4	5	329	2.3	5	562	3.8	3
96	1.6	5	331	1.5	5			
110	2.3	5	354	2.8	5			
114	2	5	356	1.5	5			
117	1.9	5	359	1.3	5			
118	1.8	5	361	1.3	5			
119	1.5	5	364	1.1	5			
135	2.1	5	376	1.8	5			
147	1.4	5	394	1.3	5			
149	2.5	5	400	1.9	5			
154	1.9	5	401	2.6	5			
156	1.5	5	576	1.4	5			

CT 207 - List of Laboratory Received a Unacceptable Score on Absorption Test

CT ID	Abs	Score	CT ID	Abs	Score
22	4.6	2	59	5.4	1
565	4.5	2	127	5	1
			219	4.9	1

CT 217 - Test Results from Initial Test

Score 5						Score 4		Score 3		Score 2		Score 1	
CT ID	SE	CT ID	SE	CT ID	SE	CT ID	SE	CT ID	SE	CT ID	SE	CT ID	SE
1	72	116	73	270	72	42	77	5	78	25	66	80	81
6	73	117	73	272	73	63	77	21	67	106	66	91	83
9	74	118	71	273	74	65	69	235	68	114	66	95	81
11	70	119	71	274	72	146	77	248	79	349	80	318	82
12	75	120	73	281	75	169	77	255	67			398	83
14	71	127	70	289	76	201	69	265	78			401	83
15	73	135	75	293	72	280	69	283	67				
17	71	137	70	295	74	294	77	291	68			123	84
18	72	139	73	297	75	296	77	345	78			219	98
19	75	141	75	301	73	308	77	364	67			Outlier	
20	75	145	72	316	74	322	77	366	78				
22	71	147	75	317	76	370	69	376	67				
23	76	148	73	325	71	387	77	385	68				
24	75	149	74	329	76			565	67				
26	72	151	70	330	73								
27	76	153	72	331	74								
31	70	154	72	333	74								
32	71	156	75	335	76								
38	72	158	70	341	75								
39	72	163	74	344	75								
45	74	164	73	348	74								
46	73	165	71	350	72								
48	71	173	72	351	71								
49	70	176	72	352	72								

50	71	178	72	354	72								
53	75	179	73	356	70								
55	71	182	74	359	72								
56	72	187	73	360	74								
59	72	200	76	361	71								
66	75	210	72	362	73								
67	75	212	73	367	72								
69	71	214	72	368	72								
70	70	216	76	379	71								
71	71	217	75	384	73								
73	76	221	72	388	72								
76	70	223	71	389	75								
77	72	224	73	393	74								
78	73	225	74	394	73								
79	72	226	73	400	73								
87	73	233	72	405	74								
88	72	234	73	407	75								
90	73	237	73	417	70								
92	70	244	71	418	76								
93	71	249	72	422	74								
96	70	253	75	439	71								
97	73	254	70	462	71								
98	72	256	75	556	75								
99	73	257	72	562	76								
101	73	261	71	569	73								
103	72	263	70	572	73								
104	74	266	73	576	72								
110	70	268	70										

APPENDIX - B

Test Results from Retest

CT 202 - List of Laboratory Received an Acceptable Final Score - Retest

CT ID	No4	No8	No16	No30	No50	No100	No200	Final Score
5	100	87	74	49	25	16	14	5
21	100	86	74	49	26	16	14	5
48	100	87	74	50	25	16	14	5
56	100	86	73	50	24	16	14	5
135	100	86	73	49	25	16	15	5
146	100	86	74	50	25	16	15	5
214	100	86	73	50	26	16	15	5
244	100	86	73	49	25	16	15	5
255	100	86	74	49	25	16	15	5
263	100	87	74	50	25	16	14	5
310	100	87	74	50	26	16	15	5
345	100	86	74	49	25	16	15	5
349	100	86	73	49	26	16	15	5
439	100	86	73	50	25	16	15	5
556	100	86	74	49	26	16	15	5
6	100	86	73	50	28	16	15	4
10	100	85	73	48	25	16	15	4
25	100	88	74	49	25	16	15	4
26	100	85	74	50	26	16	15	4

69	100	85	72	47	24	15	14	4
200	100	87	74	48	24	15	14	4
201	100	86	72	47	25	16	15	4
273	100	86	73	49	26	17	15	4
291	100	85	73	49	25	16	15	4
317	100	86	73	49	25	15	14	4
366	100	87	74	50	26	15	15	4
565	100	88	73	49	25	16	14	4
572	100	87	73	50	26	17	14	4
15	100	87	75	51	26	17	16	3
22	100	86	74	49	25	17	16	3
42	100	87	74	49	25	16	13	3
91	100	88	75	50	25	16	13	3
95	100	86	72	47	25	15	13	3
123	100	86	74	50	26	17	16	3
163	100	86	73	51	24	16	13	3
249	100	87	74	52	25	17	15	3
296	100	88	73	50	24	15	13	3
333	100	86	73	52	25	15	13	3
348	100	85	76	48	26	16	15	3
356	100	87	73	50	24	15	13	3
379	100	86	73	50	27	17	16	3

CT 202 - List of Laboratory Received an Unacceptable Final Score - Retest

CT ID	No4	No8	No16	No30	No50	No100	No200	Final Score
265	100	87	73	53	26	17	14	2
302	100	87	74	50	24	14	13	2
335	100	86	72	53	26	16	14	2
2	100	85	70	45	21	12	8	1
90	100	86	71	48	23	14	12	1
118	100	85	71	44	23	15	14	1
122	100	88	75	51	24	16	10	1
160	100	86	72	48	23	14	8	1
177	100	85	71	45	20	13	8	1
192	100	88	74	47	21	13	8	1
385	100	87	74	54	27	16	14	1
444	100	86	72	47	22	14	10	1

CT 207 - List of Laboratory Received an Acceptable Score on Specific Gravity Test - Retest

CT ID	SG	Score	CT ID	SG	Score	CT ID	SG	Score
66	2.64	5	310	2.61	5	47	2.54	4
149	2.58	5	359	2.66	5	59	2.54	4
219	2.59	5	565	2.62	5	92	2.69	4
291	2.56	5	2	2.54	4	106	2.7	4

CT 207 - List of Laboratory Received an Unacceptable Score on Specific Gravity Test - Retest

CT ID	SG	Score
366	2.16	1

Note: Passed in the initial test

CT 207 - List of Laboratory Received an Acceptable Score on Absorption Test - Retest

CT ID	Abs	Score	CT ID	Abs	Score	CT ID	Abs	Score
1	2.5	5	127	2.4	5	310	2.5	5
2	2.5	5	149	3.2	5	366	2.5	5
50	2.3	5	158	1.6	5	565	1.6	5
59	2.4	5	210	1.9	5	22	3.7	4
63	2.6	5	219	2.4	5	176	1	4
66	2.3	5	261	1.9	5	562	3.5	4
92	1.6	5	281	1.5	5	90	4	3
106	2.1	5	291	2.3	5			

CT 207 - List of Laboratory Received an Unacceptable Score on Absorption Test - Retest

CT ID	Abs	Score
370	4.3	2

Note: Passed in the initial test

CT 217 - Retest Results

CT ID	SE	Score	CT ID	SE	Score	CT ID	SE	Score
5	74	5	317	74	5	248	82	1
21	71	5	318	72	5	Note: Passed in the initial test		
25	73	5	345	76	5			
80	70	5	349	72	5			
91	75	5	364	72	5			
95	75	5	366	73	5			
106	71	5	376	74	5			
123	72	5	383	70	5			
219	74	5	398	75	5			
255	70	5	565	73	5			
265	72	5	2	77	4			
291	73	5	114	69	4			
302	72	5	444	78	3			

8. APPENDIX B: LIST OF REFERENCED CALIFORNIA TEST (CT) METHODS

CT 111 "Method of Developing Density and Moisture Calibration Tables for the Nuclear Gage"

CT 121 "Administrative Instructions for Use of Nuclear Gages"

CT 125 "Methods for Sampling Highway Materials and Products Used in the Roadway Structural Sections"

CT 201 "Method of Soil and Aggregate Sample Preparation"

CT 202 "Method of Tests for Sieve Analysis of Fine and Coarse Aggregates"

CT 207 "Method of Test for Specific Gravity and Absorption of Fine Aggregate"

CT 216 "Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates"

CT 217 "Method of Test for Sand Equivalent"

CT 227 "Method of Test for Evaluating Cleanness of Coarse Aggregate"

CT 229 "Method of Test for Durability Index"

CT 231 "Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates by the Area Concept Utilizing Nuclear Gages"

CT 304 "Method of Preparation of Bituminous Mixtures for Testing"

CT 308 "Method of Test Bulk Specific Gravity and Density of Bituminous Mixtures"

CT 309 "Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures"

CT 362 "Method of Determining Asphalt Content of Bituminous Mixtures by Vacuum Extraction"

CT 366 "Method of Test for Stabilometer Value"

CT 371 "Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage"

CT 375 "Determining the In-Place Density and Relative Compaction of Hot mix asphalt Pavement"

CT 382 "Determination of Asphalt Binder Content of Bituminous Paving Mixtures by the Ignition Method"

CT 504 "Method of Test for Determining Air Content of Freshly Mixed Concrete by the Pressure Method"

CT 518 "Method of Test for Density of Fresh Concrete"

CT 526 "Operation of California Profilograph and Evaluation of Profiles"

CT 533 "Method of Test for Ball Penetration in Fresh Portland Cement Concrete"

CT 539 "Method of Sampling Fresh Concrete"

CT 540 "Method of Making, Handling, and Storing Concrete Compressive Test Specimens in the Field"

CT 552 "Method of Test for Relative Compaction of Polymer Concrete Utilizing Nuclear Gages"

CT 556 "Method of Test for Slump of Fresh Portland Cement Concrete"

CT 557 "Method of Test for Temperature of Freshly Mixed Portland Cement Concrete"